Williams, J.K. 2010. Additions to the alien vascular flora of Mexico, with comments on the shared species of Texas, Mexico, and Belize. Phytoneuron 2010-3: 1-7. (10 March)

ADDITIONS TO THE ALIEN VASCULAR FLORA OF MEXICO, WITH COMMENTS ON THE SHARED SPECIES OF TEXAS, MEXICO, AND BELIZE

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ABSTRACT

Comparisons of databases of the alien vascular flora of Texas, Mexico, and Belize indicate that the three regions share 46 alien taxa—18 monocots and 28 dicots. In addition, comparisons revealed 24 alien taxa not previously reported from Mexico. Herbarium records and brief discussions are provided for the newly reported taxa.
KEY WORDS: vascular plants, invasive, non-native, weed, floristics, Texas, Mexico, Belize

Over the course of the last few decades it has been recognized that alien (non-native) plant taxa are contributing to the loss of biodiversity and environmental quality worldwide. The first step in monitoring and controlling the spread of the alien taxa is to identify and map the distribution of the species. Such monitoring efforts have already begun in many political regions (e.g., Kansas, Mexico, and California).

As part of the USDA-funded Sustainable Agricultural Water Conservation (SAWC) program to monitor the biological integrity of the Rio Grande, Sam Houston State University is currently involved in mapping the densities and distributions of the alien flora that occur along the river. To this effect, a database of the alien flora of Texas has been constructed (Williams & Spencer 2005) using data from herbarium specimens, literature, and field surveys. In addition to identifying the distribution of the alien flora in Texas, the project aims to determine metrics by which land managers and policy makers can identify species prone to invasiveness. One of the metrics identified in the study is the overall distribution of an alien species within its non-native range. To determine this, the database of the alien flora of Texas was compared to the alien flora of Mexico and Belize. Methods and results of the study are presented below.

METHODS

A database of the alien flora of Texas was created from herbarium studies, field surveys and various literature sources (Turner et al., 2003; Texas Invasives.org; Correll & Johnston 1970). The database was then compared to the alien flora of Belize (Balick et al. 1999) and Mexico (Villaseñor & Espinosa-Garcia 2004). Several lists were then generated from this comparison: (1) species richness values of the alien taxa in each area (Table 1); (2) taxa that occurred in all three regions (Table 2) and (3) alien taxa that were reported from Texas but not Mexico. The list of taxa reported from Texas and not Mexico was then compared to herbarium specimens from Mexico housed at the University of Texas, Plant Resources Center (TEX-LL). The purpose of the search was to determine if indeed these taxa did occur in Mexico. Numerous alien taxa were identified from Mexico that had not been previously reported. The specimen information was recorded and the verification of the identification was made by the author unless otherwise noted.

RESULTS

Table 1 lists the species richness values of alien taxa from each of the three geographic areas studied. In addition, the table lists the percent of alien taxa in each flora. From the analysis it appears that the flora of Texas includes a much higher percentage of alien taxa than either Belize or Mexico. The reasons for this discrepancy are subject to further analysis. Table 1 also lists the number of taxa that are shared between the three regions. In total there are 46 alien taxa (18 monocots and 28 dicots) that Texas, Mexico, and Belize share. The identification of these taxa is listed in Table 2. Although not listed in table form, the study also identified the number of taxa shared by Texas and Mexico (84 monocots, 176 dicots, 258 total).

The third analysis identified 71 alien taxa from 30 families that were reported from Texas but not from Mexico. The assumption made at the beginning of this study was that some of the taxa identified from Texas might have populations to the south in Mexico. Comparison of this list with herbarium records from Mexico identified 24 alien taxa that were indeed present in Mexico. The list of newly reported alien taxa to Mexico is presented below by family in Table 3. Representative specimens document the records.

DISCUSSION

By increasing our understanding of the distribution of alien taxa we can begin to develop tests and methodologies for prioritizing the taxa of main concern. The list of taxa presented in Table 2 identifies alien species with wide distributions and densities. Taxa that exhibit such a large breadth in distribution should be identified as taxa of concern and future effort should be made to curtail their spread.

Table 1. Species richness values of the alien flora of Texas, Mexico, and Belize. [1]This value calculated from Balick et al. (1999). [2]This value calculated from modified values presented in Villaseñor & Espinosa-Garcia (2004) with the additional 24 taxa presented here included.

	Belize	Mexico	Texas	Shared
Alien monocots	57	200	128	18
Alien dicots	180	441	347	28
Total alien species	237	641	475	46
% flora that is alien	2.8[1]	2.8[2]	9.8	

Table 2. The 46 alien plant species shared by Texas, Mexico, and Belize. A = number of counties in Texas (254 total). B= number of states in Mexico (31 total). C = A + B, this gives a relative idea of the taxon's distribution. The top ten taxa with the widest distributions are in bold.

Family	Species	A	B	C
Malvaceae	*Alcea rosea*	7	12	19
Fabaceae	*Albizia lebbeck*	2	6	8
Basellaceae	*Anredera cordifolia*	4	10	14
Apiaceae	*Apium graveolens var. dulce*	4	14	18
Fabaceae	*Arachis hypogaea*	12	8	20
Poaceae	*Bothriochloa pertusa*	1	8	9
Brassicaceae	*Brassica rapa*	15	26	41
Apocynaceae	*Catharanthus roseus*	4	18	22
Cucurbitaceae	*Citrullus lanatus*	14	13	27
Rutaceae	*Citrus aurantium*	11	11	22
Asteraceae	*Conyza bonariensis*	4	29	33

Apiaceae	*Coriandrum sativum*	14	24	38
Cucurbitaceae	*Cucumis anguria*	2	21	23
Cucurbitaceae	*Cucumis melo*	26	22	48
Poaceae	*Cynodon nlemfuensis*	1	12	13
Cyperaceae	*Cyperus involucratus*	10	19	29
Cyperaceae	*Cyperus rotundus*	62	27	89
Poaceae	*Digitaria ciliaris*	79	28	107
Poaceae	*Echinochloa colona*	76	29	105
Pontederiaceae	*Eichhornia crassipes*	23	29	52
Poaceae	*Eleusine indica*	51	32	83
Asteraceae	*Emilia fosbergii*	2	4	6
Cucurbitaceae	*Lagenaria siceraria*	3	15	18
Scrophulariaceae	*Lindernia crustacea*	1	2	3
Cucurbitaceae	*Luffa aegyptica*	1	17	18
Solanaceae	*Lycopersicon esculentum*	9	25	34
Meliaceae	*Melia azedarach*	74	27	101
Fabaceae	*Melilotus albus*	78	21	99
Poaceae	*Oryza sativa*	13	10	23
Poaceae	*Paspalum urvillei*	75	4	79
Poaceae	*Pennisetum purpureum*	6	16	22
Euphorbiaceae	*Phyllanthus urinaria*	13	4	17
Plantaginaceae	*Plantago major*	22	30	52
Brassicaceae	*Raphanus sativus*	5	14	19
Euphorbiaceae	*Ricinus communis*	13	31	44
Poaceae	*Rottboellia cochinchinesis*	1	4	5
Rutaceae	*Ruta chalapensis*	3	16	19
Solanaceae	*Solanum capsicoides*	3	5	8
Asteraceae	*Sonchus oleraceus*	66	32	98
Poaceae	*Sorghum bicolor*	23	27	50
Poaceae	*Sorghum halepense*	131	30	161
Sphenocleaceae	*Sphenoclea zeylanica*	1	6	7
Poaceae	*Sporobulus indicus*	53	25	78
Poaceae	*Stenotaphrum secundatum*	13	14	27
Poaceae	*Urochloa mutica*	5	16	21
Poaceae	*Vetiveria zizanioides*	2	1	3

Table 3. Alien taxa newly reported for Mexico.

APIACEAE

Cuminum cyminum L. **Chihuahua**: Llano Grande, 19 May 1960, *C.W. Pennington 140* (TEX). Det. Lincoln Constance.

Torilis arvensis (Huds.) Link **Nuevo Leon**: Santiago, Puerto Suizo, 1345 m, oak and pine forest, 16 Jun 1994, *G.B. Hinton 24424* (TEX). Det. Lincoln Constance.

APOCYNACEAE

Nerium oleander L. **Nuevo Leon**: 2 miles N of Monterrey on Hwy 85, in disturbed area, 27 May 1966, *J. Watson 10842* (TEX).

This species is native to the Mediterranean and is widely cultivated throughout Mexico. There are many representative specimens that indicate its cultivated status, but the specimen listed above is the only one collected from a disturbed rather than cultivated area This species has become widely naturalized throughout North America and there is no reason to believe its invasive habit would not persist in Mexico. Because of the heavy concentration of toxic compounds in the leaves, this species is considered an agricultural threat to grazing wildlife. The species is recognized by its shrubby habit, whorled leaves, and pink to red flowers.

ASTERACEAE

Carduus nutans L. **Hidalgo**: 5 mi S of junction MEX 85 with MEX 130, S of Pachuca, 19 Aug 1971, *D. Spellman, J. Dwyer, J. Vaughan, & R. Wunderlin 946* (TEX).

CHENOPODIACEAE

Chenopodium botrys L. **Chihuahua**: 48 km w of La Junta, 20 km E of Tomochic, on La Junta-Baseachic road, 2400 m, floodplain along stream, S of bridge across hwy, 9 Sep 1984, *F. Barrie 986 & M.E. Keidig* (TEX).

This species is readily distinguished from other species of *Chenopodium* by the presence of orange glands along the leaves and dichotomous cymes that are curved. The species is native to Europe and is a naturalized weed along gravelly areas throughout Texas and the Great Plains.

Salsola paulsenii Litv. **Chihuahua**: 82 miles N of Gallego on Hwy 45 S, creosote and *Atriplex* dominant in desert scrub community, 4150 ft, 18 Jul 1975, *E. Wallace 153* (TEX).

This species is native to southeastern Europe and central Asia. It is distinguished from the other alien species of *Salsola* in Mexico, *S. tragus* L., by its longer sepal wings (2.5–4.5 mm vs. 0.5–2.4 mm) and yellowish green leaves (vs. dark green). The species is naturalized in Texas and California.

CONVOLVULACEAE

Ipomoea wrightii A. Gray. **Jalisco**: Mpio. La Huerta, Rancho Cuixmala, on road to beach on NW side of La Loma, low inundated areas along edge of Lagoon, 5 m, 24 Oct 1990, *E. Lott 2869* (TEX). Det. A. MacDonald.

This species is native to India and is readily distinguished from other species of Mexican *Ipomoea* by its palmately compound leaves and twisted peduncles.

EUPHORBIACEAE

Phyllanthus urinaria L. **Chiapas**: Marshes surrounding the Laguna de Catazaja near the Hwy between Villa Hermosa and Merida and E of the town of Bajadas Grandes, 125 m, 11 Oct 1972, *D.E. Breedlove 28744* (TEX). Oaxaca: Orilla del río Santo Domingo, cerca de Sebastopol, 10 Mar 1968, matorrales secundarios, 150 m, *Rzedowski 25494* (TEX). **Veracruz**: Brecha, near Poblado 2, Uspanapa military reseve, secondary growth in cutover tropical rainforest, 17 Jul 1978, *J. Poole 1494* (TEX). All specimens det G. Webster.

This species is native to Sri Lanka and southeast Asia. It may become more widespread in the neo-tropics as more people may import and cultivate the species because of its reputed anti-viral (e.g., Asian flu, herpes simplex, HIV) properties.

FABACEAE

Albizia lebbeck (L.) Benth. **Campeche**: Francisco Escarcega, secondary vegetation, 27 Sep 1983, *E. Cabrera 5584* (TEX). **Sinaloa**: rolling hills 3.8 miles w of Hwy 15 at a point 7 miles N of Mazatlan, along the "Playa" orad, 1.4 m E of where it crosses railroad, thorn forest with *Acacia* and *Ficus*, 100 ft, 27 Dec 1983, *A.C. Sanders et al. 4286* (TEX). **Tamaulipas**: Along rte 85, ca 4-5 miles S of Ciudad Mante, 18 Feb 1961, *R.M. King 3839* (TEX). All specimens det. Barneby & Grimes.

Although there are additional Mexican specimens of *A. lebbeck* at TEX, these are the only specimens that appear naturalized in secondary forest or disturbed roadways.

Lotus corniculatus L. **Baja California**: Agricultural land NW of Meneadero, in turf of *Cynodon* at roadside, 10 m, 6 Sep 1980, *R. V. Moran 29207* (TEX).

This species is native to Eurasia and is an agricultural weed of concern because of the presence of cyanide compounds in the leaves. It is distinguished from other species of *Lotus* by its perennial and glabrous habit, 5 leaflets (3 at axil and the other 2 stipular in position), and solid stems.

LILIACEAE

Nothoscordum inodorum (Ait.) Nicholson **Michoacan**: Zitácuaro, entre Heroíca Zitácuaro y La Encarnación sobre la carretera Libre Federal No. 51, in roadside ditch, 6 Jun 1938, *G.B. Hinton 11936* (LL).

Native to South America and considered a noxious weed in California. This species is distinguished from other related Liliaceae by its perianth fused at the base into a tube (0.5–1 mm long), 6 fertile stamens with free filaments, and an absence of an onion-like odor.

MALVACEAE

Abutilon theophrasti Medik. **Sonora**: 9.5 km west of Resturante Puerto de la Cruz on Mex. 16 (km 258 E of Cd. Obregon), north side of Mesa el Campanero, oak woodland (28° 22' 15" N, 109° 03' 59"W), 1460 m, solitary annual in disturbed soil near corral, 12 Sep 1999, *T.R. Van Devender 99-499* (TEX). Det. P. Fryxell.

This species is native to southern Asia. It is distinguished from other species of *Abutilon* by its annual habit, leaves 10–20 cm wide, and capsules breaking up into more than 10 segments.

MORACEAE

Morus alba L. **Coahuila**: Las Rusias, Rio Santa Maria, carr. Muzquiz-Boquillas del Carmen, ca 10 km al NW de Muzquiz (28° 00' N, 101° 40' W), vegetation de huizache con *Baccharis neglecta*, 16 Sep 1992, *J.A. Villarreal 6922* (TEX). **Sonora**: Maicoba, Jul 1958, 5000 ft, *C. Pennington 213* (TEX). **Tamaulipas**: Nuevo Laredo, Reynosa street, 27 Mar 1964, *K. Peterson 56* (TEX).

Native to China, widely cultivated and escaping to riparian areas. *Morus alba* is distinguished from the Mexican species of *Morus*, *M. microphylla* Buckl. and *M. celtidifolia* Kunth, by its non-reticulate leaf surface, entire to densely lobed leaves (vs. entire), and much longer petioles (Correll & Johnston 1970; Standley 1920-1926). The specimen from Tamaulipas is obviously cultivated but is included here because of its proximity and potential to spread along the Rio Grande.

PAPAVERACEAE

Fumaria officinalis L. **Sonora**: Along the banks of the Rio Magdalena, cottonwood willow gallery (30° 37' 52" N, 110° 58' 20" W), 750 m, 8 Mar 1998, *A.L. Reina G. 98-169 & T.R. Van Devender* (TEX).

POACEAE

Chloris barbata Sw. **Veracruz**: Weed association on low roadside (XAL).

Although no specimens of this species were examined by the present author, the taxon has been reported collected from Veracruz.

This species is native to Africa and it has been reported as introduced in Costa Rica (Manual de Costa Rica). It is distinguished from the other species of *Chloris* by its 4–20 spikes and 2 rudimentary florets.

Panicum coloratum L. **Nuevo Leon**: Mpio. Salinas Victoria, Rancho Cieneguillas 5 km al SE de Mamulique, grassland, 1 Oct 1999, *J. Valdes Reyna 2576* (TEX). Det. J. Valdes Reyna

Setaria pumila (Poir.) Roem. & Schult. **Nuevo Leon**: Mpio. Galeana, La Cuesta, 1850 m, grassy roadside, 20 Oct 1989, *Hinton 19886* (TEX); Mpio. Aramberri, N of Aramberri, 1000m, by stream, 23 Nov 1989, *G.B. Hinton 19962* (TEX). **Sonora**: Mpio. Yecora, Río Maycoba, at Méx 16 (20.5 km W of Maycoba, 28.6 km E Yécora), along roadside, 1220 m, *T.R. Van Devender et al. 97-797* (TEX); NE edge of Imuris along Méx 2, 885 m, cultivated fields and pasture, 15 Sep 2000, *T.R. Van Devender et al. 2000-705* (TEX). Det. J.R. Reeder

This species is native to Europe. It is distinguished from other species of *Setaria* by its annual habit and spikelets 2.8–3.5 mm long x 1.5–2.0 mm wide that are subtended by 4–15 bristles.

ROSACEAE

Pyrus communis L. **Chihuahua**: Sierra de los Hechiceros, Cañón Encampanado, below (E of) Rancho Encampanado and above (W of) jct. with Cañon de Indio (29° 40' 30" N, 103° 36' W), canyon-bottom woods with perennial stream in dry igneous mountains, planted but surviving without cultivation, 27 July 1974, *T. Wendt & A. Adamcewicz 437* (TEX).

Although this species was reported as cultivated, the fact that it has survived in the absence of cultivation warrants its inclusion as a persistent non-native.

RUTACEAE

Ruta graveolens L.

The Mexican database (XAL & IEB) lists 18 specimens of *Ruta graveolens* from nine Mexican states. There was one specimen identified as *R. graveloens* from TEX but upon further inspection the specimen was noted to be a misidentified specimen of *R. chalapensis* L. *Ruta chalapensis* is identified as having fringed petals versus entire in *R. graveolens*. Further examination of the specimens from XAL & IEB may reveal them to be *R. chalapensis*.

SCROPHULARIACEAE

Verbascum blattaria L. **Chihuahua**: Mpio. Villa Acuña, Rancho El Rincón, on SW of Serranias del Burro (part of Sierra del Carmen), ca 80 km SE of Big Bend National Park, Texas (28° 40' N, 102° 15' W) 1400-2100 m, 11 Jul 1992, *S. Aguilar Ruiz 288* with *D.L. Doan-Crider* (TEX).

This species is distinguished from the other alien species of *Verbascum*, *V. virgatum* Stokes, by its glabrous leaves and lower pedicels 10–15 mm long.

SIMAROUBACEAE

Ailanthus altissima (Mill.) Swingle **Chihuahua**: Along road between Creel-La Bufa road and Basiguare, along arroyo, 5325 ft, 17 Oct 1972, *R. Bye 3006* (TEX). **Coahuila**: Monclova, Gloria Mts., 20 May 1936, *E.G. Marsh 1846* (TEX).

ULMACEAE

Ulmus pumila L. **Nuevo Leon**: Mpio. Galeana, ranch ca 5 mi W of San Rafael, near Ejido El Milagro, well watered area (from wells), large trees, cultivated, 1800 m, 25 Sep 1994, *G. Nesom s.n.* (TEX); Mpio. Galeana, Rancho Aguililla, 1850 m, Aug 20 1994, *G.B. Hinton 24720* (TEX).

Based on the collection dates these are relatively recent introductions to Mexico, and although the specimens are cultivated in Mexico the species is here included in the alien flora because of its aggressive and weedy nature in Texas.

VERBENACEAE

Verbena brasiliensis Vell. **Nayarit**: Wet meadows near the highway, 12 miles SE of Tepic and nearly S of Cerro Sangangüey, 1000 m, 16-18 August 1959, *C. Feddema 583* (TEX). Det. H.N. Moldenke. **Nuevo Leon**: Raices, Allende, 290 m, 19 May 1994, *G.B. Hinton 24171* (TEX); Santiago, La Botella, 1280 m, dry stream bed, 16 June 1994, *G.B. Hinton 24343* (TEX).

Vitex agnus-castus L. **Nuevo Leon**: Montemorelos, 1600 ft, 7 Aug 1970, *D. Etchinson 55* (TEX). Det. H.N. Moldenke.

This species is known as an aggressive alien in many parts of the world, including Texas. It is readily identified from other Verbenaceae by its shrubby habit, aromatic and palmately lobed leaves and sprays of blue flowers.

ACKNOWLEDGMENTS

I thank Billie Turner and Guy Nesom for reviewing the manuscript and Bethany and Patrick Spencer for work on the database. This project was funded by USDA grant A-164.

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